Fall 2019

MATH 340-001: Applied Numerical Methods

Y. Boubendir

NJIT New Jersey's Science & Technology University

THE COLLEGE OF SCIENCE AND LIBERAL ARTS

THE DEPARTMENT OF MATHEMATICAL SCIENCES

MATH 340: Applied Numerical Methods
Fall 2019 Course Syllabus

NJIT Academic Integrity Code: All Students should be aware that the Department of Mathematical Sciences takes the University Code on Academic Integrity at NJIT very seriously and enforces it strictly. This means that there must not be any forms of plagiarism, i.e., copying of homework, class projects, or lab assignments, or any form of cheating in quizzes and exams. Under the University Code on Academic Integrity, students are obligated to report any such activities to the Instructor.

COURSE INFORMATION

Course Description: Introduction to numerical methods with emphasis on mathematical models. Implements and investigates numerical techniques for the solution of linear and nonlinear systems of equations, eigenvalue problems, interpolation and approximation, techniques of optimization, Monte Carlo methods, and applications to ordinary differential equations and integration.

Number of Credits: 3

Prerequisites: MATH 211 with a grade of C or better or MATH 213 with a grade of C or better, and CS 100 with a grade of C or better orCS 101 with a grade of C or better oror CS 113 with a grade of C or better or CS 115 with a grade of C or better or MATH 240 with a grade of C or better.

Course-Section and Instructors

Course-Section	Instructor
Math 340-001	Professor Y. Boubendir
Math 340-003	Professor Y. Boubendir

Office Hours for All Math Instructors: Fall 2019 Office Hours and Emails

Required Textbook:

Title	*Elementary Numerical Analysis*
Author	Atkinson and Hal
Edition	3rd
Publisher	Addison Wesley
ISBN #	978-0471433378

University-wide Withdrawal Date: The last day to withdraw with a **W** is **Monday, November 11, 2019**. It will be strictly enforced.

COURSE GOALS

Learning Outcomes

Students succeeding in this course will be able to:

- Analyze errors arising in numerical computation of solutions to mathematical and applied problems.
- Apply numerical techniques to compute approximate solutions of nonlinear equations and differential equations.
- Apply numerical techniques for interpolation, differentiation and quadrature problems.
- Communicate advantages and disadvantages of various numerical techniques and select appropriate numerical methods for specific problems.
- Students will demonstrate the ability to translate these numerical problems into a computational algorithm.
- Student will articulate connections among course material, their other course, their majors and/or their prospective careers

Course Assessment: The assessment of outcomes will be achieved through homework, MATLAB assignments, quizzes, and examinations.

POLICIES

DMS Course Policies: All DMS students must familiarize themselves with, and adhere to, the Department of Mathematical Sciences Course Policies, in addition to official university-wide policies. DMS takes these policies very seriously and enforces them strictly.

Grading Policy: The final grade in this course will be determined as follows:

Homework, Quizzes, & Labwork	30%
Midterm Exams (2)	20% each
Final Exam	30%

Your final letter grade will be based on the following tentative curve.

A	90 - 100	**C**	70 - 75
B+	86 - 89	**D**	60 - 69
B	80 - 85	**F**	59 and below
C+	76 - 79		

Attendance Policy: Attendance at all classes will be recorded and is **mandatory**. Please make sure you read and fully understand the Math Department's Attendance Policy. This policy will be strictly enforced.

Homework Policy: Homework assignments require use of MATLAB software. Tutors are available in accordance with a posted schedule.

Exams: There will be four midterm exams held in class during the semester and one final exam. Exams are held on the following times:

Midterm Exam I	October 2, 2019
Midterm Exam II	October 23, 2019
Final Exam Period	December 14 - 20, 2019

The final exam will test your knowledge of all the course material taught in the entire course. Make sure you read and fully understand the Math Department's Examination Policy. This policy will be strictly enforced.

Makeup Exam Policy: There will be **NO MAKE-UP QUIZZES OR EXAMS** during the semester. In the event an exam is not taken under rare circumstances where the student has a legitimate reason for missing the exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor's note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the Math Department Office/Instructor that the exam will be missed.

Cellular Phones: All cellular phones and other electronic devices must be switched off during all class times.

ADDITIONAL RESOURCES

Math Tutoring Center: Located in the Central King Building, Lower Level, Rm. G11 (See: Fall 2019 Hours)

Further Assistance: For further questions, students should contact their instructor. All instructors have regular office hours during the week. These office hours are listed on the Math Department's webpage for Instructor Office Hours and Emails.

All students must familiarize themselves with and adhere to the Department of Mathematical Sciences Course Policies, in addition to official university-wide policies. The Department of Mathematical Sciences takes these policies very seriously and enforces them strictly.

Accommodation of Disabilities: Disability Support Services (DSS) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT.

If you are in need of accommodations due to a disability please contact Chantonette Lyles, Associate Director of Disability Support Services at 973-596-5417 or via email at lyles@njit.edu. The office is located in Fenster Hall Room 260. A Letter of Accommodation Eligibility from the Disability Support Services office authorizing your accommodations will be required.

For further information regarding self identification, the submission of medical documentation and additional support services provided please visit the Disability Support Services (DSS) website at:

- https://www.njit.edu/studentsuccess/accessibility/

Important Dates (See: Fall 2019 Academic Calendar, Registrar)

Date	Day	Event
September 3, 2019	T	First Day of Classes
September 13, 2019	F	Last Day to Add/Drop Classes
November 11, 2019	M	Last Day to Withdraw
November 26, 2019	T	Thursday Classes Meet
November 27, 2019	W	Friday Classes Meet
November 28-29, 2019	R-F	Thanksgiving Recess
December 11, 2019	W	Last Day of Classes
December 12, 13 2019	R & F	Reading Days
December 14-20, 2019	F - R	Final Exam Period

Course Outline

Week	Section	Topic
Week 1	1.1-1.2 1.2-1.3	Taylor Polynomial, Errors in Taylor Polynomials Evaluating Polynomials
Week 2	▪ 2.1-2.2 2.3-2.4	LAB: Floating Point Numbers Errors
Week 3	▪ 3.1 3.2-3.3	LAB: Root Finding: Bisection Method Newton's Method, Secant Method
Week 4	▪ 3.4-3.5 3.4-3.5	LAB: Fixed Point Iteration Ill-behaved Rootfinding Problems
Week 5	└▶ └▶ 4.1	REVIEW FOR MIDTERM EXAM MIDTERM EXAM I: Second Week of October Interpolation: Polynomial Interpolation
Week 6	▪ 4.2 4.3	LAB: Polynomial Interpolation Spline Interpolation
Week 7	▪ 5.1 5.2	LAB: Numerical Integration: Trapezoidal & Simpson's Rule Error Formulas
Week 8	▪ 5.2 5.3	LAB: Error Formulas Gaussian Quadrature
Week 9	▪ 5.4 5.4	LAB: Numerical Differentiation Numerical Differentiation
Week 10	└▶ └▶ 8.1-8.2	REVIEW FOR MIDTERM EXAM MIDTERM EXAM II: Second Week of November Review of ODE, Ordinary Differential Equations: Euler's Method
Week 11	▪ 8.3 8.3-8.4	LAB: Euler's Method Stability & Implicit methods
Week 12	▪ 8.4-8.5 8.7	LAB: Taylor and Runge-Kutta Methods Systems of Differential Equations
Week 13	▪ Ch.6 Ch.6	LAB: Linear Algebra Eigenvalue Problems
Week 14	▪ Ch.6 └▶	LAB: Non-linear Systems REVIEW FOR MIDTERM EXAM
Week 15	▪ └▶	LAB: REVIEW FOR MIDTERM EXAM
Finals	FINAL EXAM WEEK: DECEMEBER 14-20, 2011	